

PRELIMINARY AMENDMENT  
PCT Appln. No.: PCT/JP01/05298

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Cont.

14. The vehicle running state estimation apparatus according to claim 8, wherein a threshold value is set for the vibration level and the surface of a road is estimated to be in a low friction condition when the calculated vibration level exceeds the threshold value.

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16. The vehicle running state estimation apparatus according to claim 6 which further comprises vehicle speed detection means to estimate the condition of a road surface based on vehicle speed.

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17. A vehicle running state estimation apparatus comprising the vehicle running state estimation apparatus of claim 6, means of judging the slipperiness of a road surface based on the condition of the road surface estimated by the road surface condition estimation means and warning means for giving a warning when it is judged that the condition of the road surface is slippery.

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25. The vehicle running state estimation apparatus according to claim 6 which further comprises a transmitter for transmitting the output of the vibration detection means for calculating a time change in vibration level or a vibration level at a predetermined frequency band.

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26. The vehicle running state estimation apparatus according to claim 6 further comprising a power generating unit which is mounted to a tire wheel, generates power by the rolling of each tire and supplies power for driving the vibration detection means or power for amplifying the output of the vibration detection means.

27. A vehicle control apparatus comprising vehicle control means for controlling the running state of a vehicle based on the condition of a road surface estimated by the vehicle running state estimation apparatus of claim 6 and/or the running state of each tire.

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29. The vehicle control apparatus according to claim 27, wherein the vehicle control means controls the locked state of each wheel.

30. The vehicle control apparatus according to claim 27, wherein the vehicle control means controls the attitude of a vehicle.

31. The vehicle control apparatus according to claim 27, wherein the vehicle control means controls the air pressure of each tire.

32. The vehicle control apparatus according to claim 27, wherein the vehicle control means controls the idling state of each wheel.

33. The vehicle control apparatus according to claim 27, wherein the vehicle control means changes the inter-vehicle distance set value of an automatic driving system.

34. A tire wheel comprising the vehicle running state estimation apparatus for estimating the running state of a vehicle by detecting the vibration level of a portion below the spring of a running vehicle as set forth in claim 6 and a power generating unit for generating power by the rolling of each tire and supplying power to the vehicle running state estimation apparatus.

36. The tire wheel according to claim 34, wherein the power generating unit comprises a rotor magnetized and rotated by the rolling of each tire, a stator made from a high magnetic permeability material and adjacent to the rotor and a power generating coil installed within a magnetic circuit including the rotor and the stator.

38. The tire wheel according to claim 36, wherein the rotor is turned by rotating an unbalance weight the gravity center of the rotary cone of which is eccentric to a rotary shaft by the rolling of each tire.

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39. The tire wheel according to claim 36, wherein an air stream generated by the rolling of each tire is introduced into the power generating unit and the rotor is turned by the introduced air stream.

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